<<厚膜分子润滑-纳米技术手册-第5册>>

图书基本信息

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书籍目录

章节摘录

版权页： 插图： Solid films are also commonly used for controlling hydrophobicity and／or adhesion，stiction，friction，and wear.Hydrophobic films have nonpolar surface terminal groups（to be described later）which repel water.These films have low surface energy（15—31）dyn／cm）and high contact angle（θ≥90°）which minimize wetting（e.g.，（39.25，28，29））.Multimolecularly thick（few tenths of nm）films of conventional solid lubricants have been studied.Hansma et al.（39.30）reported the deposition of multimolecularly thick，highly oriented polytetrafluoroethylene（PTFE）films from the melt or vapor phase or from solution by a mechanical deposi tion technique by dragging the polymer at controlled temperature，pressure，and speed against a smooth glass substrate.Scandella et al.（39.31）reported that the coefficient of nanoscale friction of MoS_2 platelets on mica，obtained by the exfoliation of lithium intercalated MoS_2 in water，was a factor of 1.4 less than that of mica itself.However，MoS_2 is reactive to water，and its friction and wear propertieS degrade with increasing humidity（39.14.15）.Amorphous diamond-like carbon （DLC）coatings can be produced with extremely high hardness and are used commercially as wear-resistant coatings（39.32，33）.They are widely used in magnetic storage devices（39.2）.Doping of the DLC matrix with elements such as hydrogen，nitrogen，oxygen，Silicon，and fluorine influences their hydrophobicity and tribological properties（39.32，34.35）.Nitrogen and oxygen reduce the contact angle（or increase the surface energy）due to the strong polarity formed when these elements bond to carbon.On the other hand，silicon and fluorine increase the contact angle to 70-100°（or reduce the surface eriergy to 20-40dyn／cm），making them hydrophobic（39.36，37）.Nanocomposite coatings with a diamond－like carbon（a－C：H）network and a glasslike a-Si：O network are generally deposited using a plasma—enhanced chemical vapor deposition（PECVD）technique in which plasma is formed from a siloxane precursor using a hot filament.For fluori nated DLC，CF_4 is added as the fluorocarbon source to an acetylene plasma.In addition，fluorination of DLC can be achieved by postdeposition treatment of DLC coatings in CF_4 plasma.Silicon-and fluorine-containing DLC coatings mainly reduce their polarity due to the loss of sp^2 bonded carbon（due to the polarization potential of the involved π electrons）and dangling bonds of the DLC network.As silicon and fluorine are unable to form double bonds，they force carbon into a sp^3 bonding state（39.37）.Friction and wear properties of both silicon-containing and fluorinated DLC coatings have been reported to be superior to those of conventional DLC coatings（39.38，39）.However，DLC coatings require a line-of-sight deposition process which prevents deposition on complex geometries.Furthermore，it has been reported that some self-assembled monolayers（SAMs）are superior to DLC coatings in terms of their hydrophobicity and tribological performance（39.40，41）.

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